In the Mix

Lesson Overview: Young children spend a lot of time sorting objects by hand. However, tools can also be used to separate mixtures. In this lesson, students explore how knowledge of the properties of objects (mainly size) can be useful for separating mixtures. In this lesson, students cooperate as engineers to solve a real world problem. Given a container filled with water mixed with soil, Styrofoam, pebbles, and leaves, students use a variety of filtering tools to create a cleaner water sample.

Learning Objectives:
• Students will use tools to sort objects based on properties.
• Students will work in teams to develop a solution to a technology problem.

Academic Standards:
National Science Education Standards
Science and Technology Content Standard E: Abilities of Technological Design
• Identify a simple problem
• Propose a solution
• Implementing proposed solutions
• Evaluate a product or design
• Communicate a problem, design, or solution

Physical Science Content Standard B: Properties of Objects and Materials
• Objects have many observable properties including size, weight, shape, color, temperature, and the ability to react with other substances. Those properties can be measured using tools such as rulers, balances, and thermometers.

Benchmarks for Science Literacy
The Nature of Technology: 3C Issues in Technology K-2
• People alone or in groups are always inventing new ways to solve problems and get work done. The tools and ways of doing things that people have invented affect all aspects of life.

Time Frame: 1-2 sessions

Background for the Teacher:

The world is made of matter. Young children often love to explore matter by combining and separating objects. Mixing up concoctions in a pretend kitchen or sifting sand and shells at the beach are just two examples. When matter is combined to make a mixture, it can be separated using physical means.
A mixture contains two or more substances that are not chemically joined together. Even though the composition of a mixture is variable, each component retains its characteristic properties. Solid objects mixed together in a tossed salad, solutions such as sugar and water, suspensions such as oil and vinegar salad dressing, and colloids such as milk are all examples of mixtures.

To separate a mixture, it is helpful to know some of the properties of the components. Are any of the objects magnetic? Do any of the objects float? What size are the particles? Do any of the substances dissolve? These are all questions that touch on the physical properties of objects. Thinking about these properties helps scientists to determine strategies for separating mixtures. For example, using a magnet to separate mixtures of magnetic and non-magnetic metals at a recycling plant may be a more efficient method than separating the objects by hand. Objects that float when placed in water can be easily skimmed off the surface to separate them from a mixture. The particle size of objects will affect the size and type of filters that can be used to separate them out from a mixture. Using filters, evaporation, distillation, and absorption are just a few of the methods industries use to separate mixtures.

From oil spills to the need for clean drinking water, scientists are constantly trying to find creative ways to separate mixtures. Filtering impurities from water is a practical way students can explore a real world connection to the concept of combining and separating mixtures. While this lesson focuses on using simple instruments such as strainers and funnels to separate particles by size, many home water filtration systems may use more advanced methods to clean water. For example, some filtration systems use charcoal to absorb harmful chemicals from water. By understanding how simple tools can be used to separate mixtures, students in this primary lesson will be gaining a foundation for understanding more advanced methods of filtering.

Materials:

For the teacher
- Container of dried beans
- Container of sand
- Empty container for mixing dried beans and sand
- Broom and dustpan for spills

For the student
- In the Mix Student Resource Page
- In the Mix Home Connection Resource
- Science journal
- pencil

(For each Student Group)
- Objects good for sorting by size (e.g. buttons, beans, or blocks)
- Containers of dried beans and sand
A good scientist is a safe scientist. Do not conduct any experiment without adult supervision. This content is provided for informational purposes only; Discovery Education and 3M assume no liability for your use of the information. 3M, O-Cel-O®; Post-it® and Scotch® are trademarks of 3M. Published by Discovery Education. © 2010. All rights reserved.

- strainers
- Containers of “polluted water.” Water with Styrofoam, soil, leaves, and pebbles.
- Cheese cloth
- Coffee filters
- Funnels
- Cotton
- Spoons and other scoopers
- Mesh screens with safe edges
- Bins or boxes for catching filtered materials

Classroom Activities:

1. Divide students into small groups. Provide students with a group of objects to sort by size (e.g. buttons, dried beans, or blocks of different sizes)

2. Discuss how a mixture is a combination of two or more substances that are not chemically joined together. Just as students separated the group of objects based on physical properties, mixtures can be physically separated.

3. Show students a container of dried beans and a container of sand. Allow students to observe and describe the physical properties of the beans and the sand. Tell students to watch as you mix together the beans and sand. Ask: What are some strategies that could be used to separate the beans and sand? Allow students to brainstorm some ideas. Which strategies would be the most efficient? (e.g. Strainers would be more efficient than separating the mixture by hand.)

4. Show students a strainer. Allow students to predict what might happen if the mixture is poured into the strainer. Students should explain the reasoning behind their predictions. (e.g. The sand would fall through the holes while the beans would remain on the surface because the beans are larger than the holes.) Provide students with the opportunity to test their predictions. Be sure to discuss methods for catching the filtered materials to avoid too much mess.

5. Discuss how scientists use knowledge about separating mixtures to solve real world problems. Humans and other animals need clean water to survive. Sometimes, water can get polluted from litter, oil spills, soil erosion, etc. When water is polluted, often scientists look for ways to clean the water. Show students a container filled with “polluted” water. Tell students that the water is a mixture of soil, pebbles, leaves, and Styrofoam.

6. Divide students into small groups. Show students a variety of materials (strainers, mesh screens with safe edges, cheese cloth, coffee filter, funnel, cotton, spoons, etc.) Give students the task of finding a way to separate the components of the mixture to obtain the cleanest water sample they can using the
materials provided. After groups have created a plan, allow them to sketch the plan, carry out the plan and record the results using the In the Mix Student Resource Page.

7. Provide students the opportunity to practice communication skills as they share the results of their investigations with the rest of the class. Which strategies and materials obtained the best results? Why? How did the properties of the objects affect how the mixture could be separated? (The size of objects affected the ability of the object to fit through strainers of different sizes. Some objects like Styrofoam floated to the top and could be easily removed by skimming the surface.)

8. Discuss how a filter is a tool used to separate mixtures. Ask students to think about other examples of filters they have seen and why they are used (e.g. coffee filters, water filters, air filters, etc.) Students should describe in their science journals an example of a mixture and how it can be separated.

9. Bring closure to the lesson, by allowing a few students to share their journal responses.

Home Connections:

Allow students to select one of the following activities to complete at home with a parent.

- Predict what will happen when salt and warm water are mixed together then test to determine the results. (The salt will dissolve in the water.) Place the salt and water mixture in a shallow bowl and place it in direct sunlight. Observe and discuss what happens to the contents of the bowl. (The water will evaporate, leaving behind the salt.)

- Search for everyday examples around the house where substances are combined (mixed) and/or separated and record these examples as a list. (e.g. separating pasta and water when cooking, combining drink mixes with water, air and water filters, etc.)

Assessment: Use the following rubric to score student responses to the journal task stated in Step 8 of the lesson.

2- Complete Understanding: Student describes an example of a mixture AND how it can be separated.
1- Partial Understanding: Student describes an example of a mixture OR how it can be separated.
0- Student response is off topic or not related to mixtures.
Name_____________________________  Date____________________

Clean it Up!

Engineers use technology to solve problems. Work as a team to solve the problem below:

Problem:
Help! Some water has become polluted with extra soil, trash, and other materials.
Find a way to clean up the water sample you have been given using materials provided by your teacher.
1. PLAN
Draw a sketch of your plan for cleaning the water in the space below. Be sure to label your sketch.

2. TEST
Use words and/or pictures to describe what happened after testing out your plan.

3. RESULTS

Evaluate. Is there any part of the plan you would have changed? Explain.
Dear Parent or Guardian,

Your child has been learning about properties of materials and how they can be mixed and separated. Today your child worked on an engineering team to develop a filtering system for “polluted” water. Select one of the following tasks to complete together with your child to help reinforce and apply his/her understanding of science concepts:

- Predict what will happen when salt and warm water are mixed together then test to determine the results. (The salt will dissolve in the water.) Place the salt and water mixture in a shallow bowl and place it in direct sunlight. Observe and discuss what happens to the contents of the bowl. (The water will evaporate, leaving behind the salt.)

- Search for everyday examples around the house where substances are combined (mixed) and/or separated and record these examples as a list. (e.g. separating pasta and water when cooking, combining drink mixes with water, air and water filters, etc.)